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Stimulating Influences in the Production of Larger Yields of Potatoes per Acre at a Lower Cost per Unit

WM. STUART, U. S. Dept. of Agriculture, Washington, D. C.

The stimulating influence of competition has no better exponent today than that of the 300, 400 and 600 bushels per acre potato clubs. Prior to the organization of such clubs potato growers were occasionally stimulated to produce exceptional yields through the offer of attractive prizes by certain commercial interests. A leading example of this sort occurred in 1889 and was repeated in the case of the potato in 1890. This competition was sponsored by the American Agriculturist which announced early in 1889 the terms on which such competition would be conducted and that a cash prize of $500.00 in gold would be awarded to the winner. Fertilizer companies, implement manufacturers and individual states contributed additional prizes for largest yields produced from the use of their special brand of potato fertilizer or by a grower within the state.

The competition in 1889 included, in addition to potatoes, oats, corn and wheat.

The winner of the American Agriculturist's potato prize in 1889, Mr. Charles B. Coy, Presque Isle, Me., produced 738 bushels and 25 pounds on an acre of land lacking 193½ square feet of being a full acre. The next highest competitor was Mr. Alfred Rose of Penn Yan, N. Y. with 669 bushels 53½ pounds per acre.

Owing to the unusually severe occurrence of late blight in 1889, which ruined the crops of many competitors, the American Agriculturist acceded to an insistent request on the part of these growers to repeat the contest, so far as it related to potatoes, in 1890. In that year the Agriculturist renewed its

prize of $500.00 but split the amount into four prizes of $200.00, $150.00, $100.00 and $50.00. As in the previous year many commercial interests again joined forces to the extent that some 41 prizes were offered.

Of the 41 crops reported in 1890, which exceeded the 250 bushel minimum yield and fulfilled all other requirements of the test, there were 22 growers who produced over 400 bushels per acre; 14 between 300 and 400 and the remaining five between 258.5 and 300 bushels. The topnotchers were W. J. Sturgis, Buffalo, Wyo. with a yield of 974 bushels 48 lbs.; R. A. Chisholm, Del Norte, Colo., 847 bus. 32 lbs.; Philo J. Reed, Ft. Fairfield, Me. 745 bus. 25 lbs.; A. M. Dudley, Mapleton, Me., 605 bus. 6¾ lbs.; Joseph T. Mead, Reeder, Wash., 595 bus. 38 lbs.; E. W. Houghton, Maple Grove, Me., 579 bus. 46 lbs.; and Albert L. Haines, Maple Grove, Me., 547 bus. 49 lbs.

The geographical distribution of the 41 winners was as follows: One each from Colorado, Connecticut, Idaho, Indiana, Michigan, Vermont, Washington and Wyoming; two each from Massachusetts, Minnesota and New Jersey; Pennsylvania had four; New York six, and Maine 17.

In addition to the 41 who met all requirements of the competition, partial reports were received from several hundred farmers claiming estimated yields of from 100 to 400 bushels, as well as quite a number of complete reports from those whose yields fell below 250 bushels.

It should be stated that in both the 1889 and 1890 competitions the yield was from an accurately surveyed acre made by a competent surveyor and the total crop was harvested and weighed in the presence of disinterested parties charged with the responsibility of testifying under oath that the yield was accurately recorded.

Although the 1889 seasonal conditions were considered sufficiently undesirable to justify a repetition of the contest in the following year, the report of the 1890 weather conditions seem to have been more unfavorable, the average yield per acre in 1889 being 77.4 bushels and in 1890, 55.9 bushels. In view of this the yields obtained by the competitors in 1890 were quite remarkable.

A full account of the prize awards in 1889 and 1890 may be found in volume 49 of the American Agriculturist pp. 35, 36, 40 and 684-688, 1890.

The next contest of national importance was that sponsored by the Bowker Fertilizer company in 1912 involving prize money totaling $500.00. The rules governing this contest stipulated that the prizes would be awarded for the largest yields of best quality table size potatoes of good ap-

pearance grown exclusively on a specific brand of potato fertilizer. The chemical tests for starch were made by the Massachusetts State Agricultural Experiment Station. Table quality was determined by boiling and baking all samples under identical conditions. Size and appearance were also considered in the general rating of each lot.

Seven prizes were awarded in this contest and all but one of the winners were Maine growers. The first prize of $200.00 was awarded to L. A. Littlefield of Lincoln, Me., who produced 545.4 bushels, 77 per cent of which were table size and scoring perfect as to cooking qualities and nearly so in regard to shape and appearance. The total score in points was 714 out of a possible 1000. George A. Burditt of Rochester, Vt. won the second prize of $100.00 with a yield of 527.2 bushels, 73 per cent of which were table size and almost perfect as to cooking quality and appearance. This lot scored 696 points.

In all there were 81 entries and 33 of them completed the test.

Restrictions as to use of special brands of potato fertilizers in order to be eligible for competition were no doubt responsible for a limited geographical participation in this contest.

Potato Club Contests

The organization of a 400-bushel per acre club by Pennsylvania potato growers in 1922 marked the beginning of a definite production per acre membership club. Prior to this date 1917-1921 inclusive, Dr. E. L. Nixon of the Pennsylvania State college had enlisted the active cooperation of a considerable group of potato growers in a definite attempt to increase production per acre and of decreasing the cost per bushel or hundred weight. The present success of the various 300, 400 and 600 bushel potato clubs is, in a large measure, due to the impetus given to this movement in Pennsylvania.

Colorado 600-Bushel Potato Club

The Colorado 600-bushel club was organized in Rio Grande county in 1927. It is rather remarkable that of the fifteen fields entered for certification, eleven produced over 600 bushels. Owing to the fact that two of the contestants entered two fields each, the membership was really limited to nine individual growers. So far as known the Colorado club is the only organization permitting entry of more than one field by any individual in one competitive contest.

As a first season proposition some rather interesting yields

were secured. Six of the eleven fields produced over 700 bushels per acre and one yielded 833.2 bushels.

The average acre production of the eleven qualifying fields were 711.1 bushels. The previous crop grown was in eight cases, alfalfa, two, peas, and one potatoes following alfalfa.

In 1928 owing to an unfavorable growing season only four growers produced yields in excess of 600 bushels. Two of these was 711.1 bushels. The previous crop grown was in eight H. C. Henry, whose yields were 1047 and 688 bushels respectively. It is interesting to note that Garfield county organized a potato-king contest in 1928 and one of its contenders, Willie Haas, produced 616 bushels. The fourth member was a Rio Grande county grower who made a yield of 718 bussels. Two of the four records were made with Prolific (Brown Beauty) and the remaining two with Peachblow and Russet Rural. Three of these yields were produced on an alfalfa sod, one of which (Mr. Schutte's) had been manured, and one following potatoes which in turn had followed alfalfa and was manured for the 1928 crop.

The 1929 competition was in a certain sense a repetition of the 1927 one insofar as number of fields and individuals is concerned. For example eleven fields produced over 600 bushels and two growers qualified on two fields each, viz. L. G. Schutte and Alvin McGraw. As in the two previous seasons Schutte led with a yield of 1145.17 bushels from one field and 869.8 bushels from the other. The latter yield was exceeded by that of C. P. McKelvie, who produced 917 bushels. The average yield of the eleven fields was 732.56 bushels per acre. The Prolific variety was used in four of the fields and an equal number were of the Rural variety while there was one field each of Peachblow, Russet Rural and Triumph. Three of the fields were located in Rio Grande county. Six in Montrose, and one each in Alamosa and Garfield.

Six of the fields were grown on an alfalfa sod, three of which had received manure; three followed potato, and two sweet clover.

Summarizing the three seasons' accomplishments it is noted that of 26 fields qualifying 17 were from Rio Grande county, six from Montrose, two from Garfield, and one from Alamosa county. L. G. Schutte of Monte Vista had the enviable distinction of making the club each of the three seasons. H. C. Henry, also of Monte Vista, made the club in 1927 and 1928 but failed in 1929. The average yield per acre of the 26 qualifying fields was 736.97 bushels. Fifteen of the yields were between 600 and 700 bushels; six between 700 and 800; two between 800 and 900; one between 900 and 1000; one between 1000 and 1100, and one between 1100 and 1200 bushels

per acre. An average of 29.22 bushels per acre of seed was planted, while the actual amounts varied from 20 to 96.7 bushels. Fifteen records showed an average of 3.54 cultivations during the season.

Eighteen fields were subirrigated, the other eight were irrigated on an average of six and one-quarter times. Eighteen growers used whole seed while eight employed cut seed.

Production costs were found to coincide rather closely with yield, that is the higher the yield, the lower the cost per bushel or hundredweight. Five of the records were made at an average cost of $1.20 per cwt.; three for 87c; five for 60c; seven for 53c; one for 45c, and one for 42c.

In 1930, twenty fields produced yields in excess of 600 bushels. No other information in regard to the 1930 contest is available to the writer at the present time.

For fuller information concerning the 1927, 1928 and 1929 contests the reader is referred to Bulletin 228-A of the Colorado Agricultural College Extension Service, entitled, "The 600-Bushel Club of Colorado."

Connecticut 250 to 300-Bushel Potato Club

According to our informant the Connecticut 250-300-bushel per acre potato club was organized either in 1924 or 1925. No accurate data seems to be available prior to 1929. In that year the average yield of the 13 members was 284 bushels, while the nine 1930 members averaged 327 bushels. The highest yield in 1929 was 565 bushels and in 1930 was 635 bushels per acre.

The Green Mountain variety was found to give the highest yields.

The average application of commercial fertilizer was 2000 pounds.

Between 20 and 22 bushels of seed per acre was used on the average. The largest amount was 30 bushels.

The crop received an average of seven cultivations and was sprayed from nine to 15 times.

The average cost of growing an acre varied from $200.00 to $250.00.

Massachusetts 300-Bushel Potato Club

A 300-bushel per acre potato club was organized in Massachusetts in 1927 and nine growers qualified for membership. The 1928 membership consisted of thirteen, while five qualified in 1929 and twenty-six in 1930.

The average acre yield of the 1927 members was 370 bushels, 355 in 1928, 354 in 1929 and 408 in 1930. The three highest

yields in these four years average respectively 450, 455, 415 and 596 bushels.

In 1927, 1929 and 1930 the Green Mountain proved to be the highest yielder while this honor went to the Irish Cobbler in 1928.

Most growers used both barnyard manure and commercial fertilizer.

An average of 13.3 bushels per acre of seed was used in 1927; 14.3 in 1928; 15 in 1929 and 17.1 bushels per acre in 1930. The largest amount of seed used during each of the four years was 22, 21, 23, and 25 bushels respectively.

The crop was cultivated an average of six times in 1929 and 6.9 times in 1930.

The vines were sprayed an average of 7.1 times in 1927, 7.2 times in 1928 and 9.2 times in 1929.

Michigan 300-Bushel Potato Club

The 300-bushel Michigan potato club was organized in 1922. Up to 1931, membership in the club was restricted to the growers of certified seed potatoes. Beginning with 1931 growers of table stock potatoes who are members of the New Standard Potato club of Michigan are eligible to membership, provided they are able to produce the necessary yield.

A brief summary of the results to date is presented in Table 1.

TABLE 1—Some 300-Bushel Potato Club Data—1922-1930.

Year	No. of Members	Total Average Yield per Acre	Average of Three Highest Yields per Acre	Average Application of Manure per Acre	Average Application of Commercial Fertilizer per Acre	Average Amount of Seed Used per Acre	Ave age Num ber of Cul vati
1922	10*						
1923	10*						
1924	37	373 bus.	483 bus.	12 loads	610 lbs.	21.2 bus.	
1925	23	342 bus.	405 bus.	12 loads	610 lbs.	21.2 bus.	2
1926	34	359 bus.	423 bus.	12 loads	610 lbs.	21.2 bus.	3
1927	7	331 bus.	363 bus.	12 loads	610 lbs.	21.2 bus.	1
1928	61	360 bus.	427 bus.	12 loads	610 lbs.	21.2 bus.	1
1929	11	334 bus.	363 bus.	12 loads	610 lbs.	21.2 bus.	2
1930	11	332 bus.	358 bus.	12 loads	610 lbs.	22.0 bus.	2

*No other data furnished.

The figures given in regard to applications of manure and of chemical fertilizers are approximations rather than absolute amounts but are believed by those contributing the data to be

sufficiently accurate for all practical purposes. The same statement applies with respect to the average amount of seed planted per acre. The largest amount of seed used by an individual grower was 40 bushels in 1924 and 31 bushels in 1930.

The highest yielding variety throughout the competition was the Russet Rural.

The average number of sprayings throughout the period involved was six.

Production costs per bushel of the club members averaged 40 cents per bushel. The lowest cost reported was 29 cents and the highest 50 cents per bushel.

New Jersey 300-Bushel Potato Club

The New Jersey 300-bushel potato club was organized in 1926, and three growers qualified for membership. This number was increased to 16 in 1927, 18 in 1928, dropped down to eight in 1929, and was swollen to 30 in 1930. Outside of membership no data were supplied except for 1930.

Very little barnyard manure was used by the growers but close to a ton of commercial fertilizer was used per acre in 1930.

The average amount of seed used in 1930 was 17.86 bushels per acre, while the largest amount was 25 bushels.

Twenty-three of the 1930 members used the weeder an average of 2.6 times and the cultivator 4.1 times.

Spraying by individual growers ranged from two to 12 times.

The three highest yields in 1930 were 456, 399 and 398 bushels respectively of U. S. No. 1. The average yield per acre on 29 farms was 347.1 bushels No. 1's and 25.3 bushels No. 2's or a total of 372.4 bushels.

The average net cost per acre of U. S. No. 1 tubers was $169.70 while the lowest cost was $122.73 and the highest $222.30. On the same basis the average bushel cost was 49.2 cents, with the lowest cost 31.9 cents and the highest 69.3 cents.

The requirements of the club in 1931 call for a yield of 350 bushels per acre of the U. S. No. 1 potatoes. Had such a requirement been made in 1930, sixteen of the 30 members would have been eligible.

The data given in Table 2 affords some very interesting comparisons particularly with respect to cost of seed and of care of the crop.

The net cost per acre figures were obtained by deducting the estimated value of the No. 2 or seconds' tubers from the total cost. They represent therefore the actual cost of growing the U. S. No. 1 tubers.

TABLE 2.—Summary of Yields, Production Costs and Profits of New Jersey Potato Club Members in 1930.

Record No.	Bushel yield per acre U. S. No. 1	Seed		Fertilizer		Cost Spray material	Man labor cost	Power and equipment cost	Land rental	Net cost		Receipts per bushel	Profit per bushel
		Bu.	Cost	Pounds	Cost					Per acre	Per bushel		
No.													
1	399	23.3	$36.12	2350	$30.98	$11.05	$70.07	$42.25	$16.00	$213.18	$.534	$1.10	$.566
2	398	25.-	82.85	1852	29.11	12.92	16.98	18.64	8.00	182.48	.457	1.20	.743
3	388	17.-	43.87	2000	29.00	10.11	28.55	15.37	16.00	151.80	.391	.86	.469
4	385	15.-	30.00	1800	32.40	1.83	29.83	10.09	8.00	12273	.319	1.10	.781
5	367	17.25	41.54	2004	26.55	6.24	34.86	20.56	10.00	154.46	.420	.86	.440
6	366	17.5	43.40	2100	40.16	6.51	32.42	12.80	15.00	153.02	.418	.844	.426
7	364	17.2	51.60	1860	34.71	5.86	21.49	15.46	10.00	151.02	.415	1.00	.585
8	363	16.25	29.25	†850	*28.05	3.63	44.48	16.50	10.00	154.21	.425	.87	.445
9	360	18.-	45.36	†800	30.40	12.00	50.30	29.46	22.00	200.27	.556	1.44	.884
10	360	17.5	35.35	1500	*24.75	7.96	61.28	33.78	10.00	166.13	.461	1.30	.839
11	358	16.1	40.57	2150	29.85	3.94	26.10	14.93	25.00	159.78	.446	1.00	.554
12	357	15.-	43.50	2000	*36.47	3.71	4 .??	45.33	15.00	222.30	.623	.82	.197
13	356	14.-	36.74	1935	29.68	2.61	33.11	15.30	15.00	143.30	.402	.783	.381
14	353	17.92	40.51	2050	38.44	2.10	46.20	25.21	12.50	184.64	.523	.98	.457
15	350	13.75	30.25	1800	30.15	6.71	53.14	41.90	10.00	187.58	.536	.85	.315
16	345	12.5	30.00	800	*14.00	5.50	43.71	20.02	12.00	133.56	.387	1.04	.650
17	345	22.5	36.00	2300	39.10	4.87	28.94	25.28	20.00	151.23	.438	.71	.272
18	341	18.-	43.20	2400	42.00	10.50	44.88	29.29	22.00	204.60	.60	1.20	.60
19	339	20.-	52.00	2250	38.22	4.20	24.91	9.51	10.00	140.72	.415	.717	.302
20	337	19.38	45.00	†765	*25.50	4.74	29.89	16.48	20.00	148.80	.442	.74	.298
21	332	15.-	42.00	2000	31.75	2.84	25.45	22.68	12.00	140.78	.418	.80	.382
22	325	14.18	39.67	2500	41.60	1.82	36.10	57.28	9.00	182.94	.563	1.04	.477
23	320	22.5	67.75	1200	22.20	5.82	24.45	18.38	20.00	221.73	.693	.884	.191
24	315	20.-	48.00	2200	*37.85	4.05	38.77	19.06	10.00	163.45	.516	.99	.474
25	314	14.12	36.72	2100	36.75	4.89	37.79	30.78	14.00	171.93	.547	.84	.293
26	311	25.-	40.00	2300	*45.19	4.95	43.60	22.99	13.00	177.93	.572	1.05	.478
27	310	15.-	36.00	†800	*31.90	6.00	47.95	25.98	12.00	180.15	.581	.84	.259
28	306	20.-	44.00	2000	*32.25	8.71	41.34	35.76	10.00	203.07	.664	1.20	.536
29	303	18.1	29.00	2200	38.50	4.55	28.80	20.74	20.00	153.62	.507	.90	.393
30	456[1]	25.-	82.50	2050	*31.19	12.85	35.36	26.25	10.00	229.87	.504	1.00	.496
Ave.	347.1	17.83	41.84	1986	33.27	5.88	37.47	24.54	14.02	169.70	.492	.964	.472

*Some manure used. †Concentrated fertilizer. [1]Under irrigation.

New York State Potato Club

New York State has adopted a somewhat different plan of organization than that previously discussed. According to Dr. Hardenburg the organization is known as the Empire State Potato Club which has provided for a Premier Potato Growers' Contest, the purpose of which is to encourage efficiency in production. Membership in the Premier Potato Growers' Contest is based on three factors, viz:—(1) Low cost of production per bushel; (2) Yield per acre of U. S. No. 1 potatoes; (3) Total field run. The contest was originally established on a 3-acre minimum but it now applies to the growers' entire acreage.

The rules promulgated for the conduct of the test are as follows:

1. The contest will be based on a record kept for the entire potato acreage grown by the contestant. This acreage must be specified not later than June 15 and the number of fields and acreage of each recorded in the record book supplied.
2. Total or field-run yield per acre will be determined from figures furnished by the grower or the total harvested crop from his entire potato acreage. In no case will corrections for poor stand or other irregularities be permitted in calculating yield. To insure greater accuracy in determining total harvested yield, it is suggested that growers keep record not only of number of crates harvested but also of average weights of sample crates as a basis for computing total in bushels.
3. At time of digging, the county agent will sack and seal a representative field-run sample to be stored at the farm for purposes of inspection, grading, and exhibition. The sample for determination of grade shall consist of at least 2 bushels from each field and in no case shall the sample be of less than 5 bushels. An additional 100-pound field-run sample shall also be sacked and sealed at this time by the county agent for the annual potato show.
4. Yield per acre of U. S. No. 1 grade shall be determined from the sacked and sealed sample, by an authorized agent of the New York State Department of Agriculture and Markets, and the record filed with the Secretary of the Club not later than December 15.
5. Each contestant is required to exhibit a 100-pound **field-run sample** at the annual potato show at Rochester in January, this sample to become the property of the Club. These exhibit samples will compete for premium awards on the basis of market quality.
6. The potato record book must be completed and returned to your local county agent not later than December 1.

30	456[1]	25.-	2050	*31.19	12.85	35.36	26.25	10.00	229.87	.504	1.00	.496
Ave.	347.1	17.83	1986	33.27	5.88	37.47	24.54	14.02	169.70	.492	.964	.472

*Some manure used. †Concentrated fertilizer. [1]Under irrigation.

7. Muck growers, Long Island growers, and upstate upland growers are all eligible to the contest, but owing to differences in both cultural and economic conditions, the basis of calculating the final ratings will differ for each of these three groups.
8. Premier Potato Grower awards will be made on the following basis:

Cost of growing and harvesting per bushel of U. S. No. 1 grade	50%
Yield per acre of U. S. No. 1 grade	40%
Total or field-run yield per acre	10%

The New York organization was established in 1928 and ten contestants qualified for membership the first year and approximately the same number have qualified each succeeding season. In 1928 the average yield of the 10 contestants was 302 bushels; in 1929, 276 bushels, and in 1930, 249 bushels. More complete data are presented in table 3.

TABLE 3.—New York State Premier Potato Growers Contest Data—1928-1930.

Year	No. members	Ave. yield per acre.	Highest yields per acre	Variety giving highest yield	Amount of com. fert.	Amount of manure	Ave. amt. seed per acre	Largest amt. seed per acre	Ave. No. cultivations	Ave. times sprayed	Ave. cost per acre	Ave. cost per bushel
			397		lbs.	tons	bus.	bus.				
1928	10	302	390	Russet								
			379	Rural	875	10	20.8	31	3.6	6	$134.03	$.44
			565									
1929	10	276	492	Irish								
			400	Cobbler	1115	10	21.9	35	3.3	6	$109.42	$.39
			372									
1930	10	249	342	Green								
			341	Mountain	722	10	21.3	28.3	3.0	5.5	$124.14	$.49

Ohio 300 and 400-Bushel Potato Club

The Ohio 300-bushel potato club was organized in 1925 and operated as such for three seasons after which it was converted into a 400-bushel club. The accomplishments of this club as summarized in Table 4 indicates the possibilities of increasing yields per acre through the stimulation of a carefully conducted contest. The competition has also served another purpose in that it has emphasized the importance of keeping accurate cost account records.

TABLE 4.—Summary of Data Obtained From the Ohio 300 and 400 Bushel per Acre Potato Contest 1925-1930.

Year	No. Members	Aver. Yield per Acre	Three Highest Yields	Variety Giving Highest Yields	Aver. Amt. Commercial Fertilizer	Aver. Amount Manure Used	Amt. Seed Planted	Largest Amt. Seed Used	Aver. No. Cultivations	Aver. Times Sprayed	Aver. Cost per Acre	Aver. Cost per Bu.
		Bus.	Bus.		Lbs.	Loads	Bus.	Bus.				
			458.0	Smooth								
			346.0									
1925	3	371.0	310.0	Rural								
			497.0	Smooth								
			496.0									
1926	10	404.0	428.0	Rural	1042	12½	17.5	22½	8.0	2.2	$147.38	$.365
			606.0	Smooth								
			468.0									
1927	30	358.0	456.0	Rural	883	12	17.5	22	8.0	5.0	151.60	.423
			520.0	Russet								
			503.0									
1928*	29	436.0	502.0	Rural	900	9	22.0	28	8.0	8½	140.06	.321
				Russet								
1929	17	455.0		Rural	964	9½	23.0	28	9.0	9.0	141.94	.312
			632.0	Russet								
			538.0									
1930	24	470.0	525.0	Rural	1041	13	23.0	29	8.0	9½	156.00	.332
Ave.		415.7	485.7		966	11.2	20.6	25.9	8.2	6.8	$147.40	$.351

*400-bushel club organized in 1928.

Some rather interesting figures, based on the 1928 data of the Ohio 400-Bushel club, were presented by Miller[1] at a meeting of the Ohio Vegetable Growers Association in which the relation between yield and cost per unit of production was emphasized. The variation in yields of the 52 contestants for membership in the club was from 57 to 426 bushels, while the cost per bushel varied from $2.38 to 32 cents.

Further analysis by Miller showed that the low-cost producer was second highest in average yield per acre, while the high-cost man had the lowest yield. The data furthermore showed that growers producing 350 bushels per acre did so at an average cost of 34.9 cents per bushel. Yields between 300 and 350 bushels were made at an average cost of 43.3 cents; those ranging from 250 to 300 cost 49.6 cents per bushel; 200 to 250 bushels per acre yields had a cost average of 59.2 cents per bushel; the 150 to 200-bushel grower did so at an average cost of 75.1 cents per bushel, while the 100 to 150 bushel man's cost was 89.4 cents per bushel. Less than 100 bushels per acre yields, involving 37 acres, cost $1.74 per bushel.

The value and significance of such data can hardly be overestimated. In fact, they furnish conclusive evidence of the importance and far-reaching benefits resulting from properly conducted potato club contests.

Pennsylvania 400-Bushel Potato Club

While the Pennsylvania 400-bushels per acre potato club was not organized until 1922, potato yield contests actually began five years prior to this date under the able leadership of E. L. Nixon of the State Agricultural College. In the absence of official data relative to the actual accomplishments during this preliminary 5-year period we are obliged to pass over it and begin with the 1922 organization. The data presented in Table 5 show the membership for the years 1922 to 1930 inclusive but is lacking in information regarding the average yield per acre of those qualifying for membership. With the exception of 1922 complete figures are available with respect to average amount of seed planted, pounds of commercial fertilizers applied to the crop and the per cent of growers who used barnyard manure. From 1924 on complete information is given regarding the average width of rows and the distance between sets. The per cent of growers using the weeder in pre-emergence tillage and the average number of cultivations given the crop after emergence is available from 1925 on, while the average number of sprayings is given from 1923 to 1930.

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[1]Miller, Guy.—Variation in cost of growing Ohio potatoes in 1928. Proc. 14th Ann. Meeting Ohio Veg. Gr. Assoc. 1929 p. 21-23.

More intimate information in regard to lessons to be derived from 400-bushel potato growers in 1927 is taken from Dickey's[1] paper in which he comments on some of the results of that year's contest. In this paper it is noted that there were six yields in excess of 600 bushels and 30 over 500 bushels. Amos Eberly topped the list of 187 successful growers with a yield of 651.4 bushels, while Ray Briggs, the top-notcher of 1926, produced 631 bushels. Briggs' 1926 record was 688 bushels, which, by the way, was an average for 12 acres.

TABLE 5.—Summary of Membership, Yields and Cultural Methods of Pennsylvania's 400-Bushel Club —1922-1930.

Year	Number members	Largest yield	Ave. amount seed used	Ave. amount commercial fertilizer	Per cent using manure	Ave. width of rows	Ave. spacing in row	Per cent used weeder	Ave. number cultivations	Ave. times sprayed
		Bus.	Bus.	Lbs.		In.	In.			
1922	14									
1923	55		17.6	825	96					7
1924	53	637	20.-	1200	90	34	11.7			7
1925	39	571	20.3	970	87	32	12.	80	5.3	8
1926	97	688*	20.5	1050	90	32.4	11.	70	5.8	9.1
1927	187		23.	1133	85	31	10.5	90	4.9	11.3
1928	385		24.3	1175	84	30.9	9.8	87	3.1	11.3
1929	91		25.7	910	75	30.5	9.5	90	3.3	12.5
1930	50		26.	1017	82	30.8	10.	90	2.8	12.
Ave.			22.2	935	86.1	31.7	10.6		3.6	9.8

*Average of 12 acres.

Thirty-six of the 67 counties of the State were represented in 1927. It is also regarded as indicative of the relative non-importance of specially adapted soil areas for potatoes that 57 of 67 counties have in some season between 1922 and 1927 had representation in the 400-bushel club.

Forty-nine of the 187 club members in 1927 had grown 400-bushel crops in previous years; seven had qualified in four of the six years; twenty-six had made the goal three years, and sixty-one, two years. Ray Briggs and Dick Simons enjoyed the distinction of making the club five years in succession.

Sixty per cent of the group had planted Michigan grown seed, while 73 per cent of the high third group used new seed from

[1]J. B. R. Dickey.—Lessons from our 400 bushel potato growers.—The Guide Post 5 No. 1 p. 1, 5, 6, 8, 10, Feb. 1928.

Michigan. All the 600 bushel crops were produced from Michigan seed.

The steady increase in the average amount of seed planted per acre is also regarded as a significant factor. Improvement in cultural practices is also noted especially in more frequent sprayings.

In discussing the methods employed in the production of Pennsylvania's high potato yield in 1930, Houston[1] says: "The production of Pennsylvania's champion potato yield for 1930 of 603 bushels was accomplished by no innovation in management but by a rather strict adherence to the cultural and disease control practices worked out by E. L. Nixon and his associates at State College."

Humus was provided by turning under a heavy crop of soy beans grown on a Hagerstown silt loam soil already higher in organic matter than the average Pennsylvania soils. The soy beans were disked into the soil the previous autumn and the field was plowed early the following spring. It was planted the last week of April with 25 bushels of certified Russet Rural seed in rows 32 inches apart and a 9½ inch spacing in the row. An application of 950 lbs. of 3-10-6 fertilizer was made in the row at the time of planting. The seed was planted in furrows about 3½ inches in depth but was covered shallow and filled in with later cultivations.

Spraying was started with the appearance of the leaves and continued on a weekly schedule as long as the vines were green except that during an extreme heat period the intervals were reduced to five days. A 4-4-50 Bordeaux mixture was applied at a pressure of 400 lbs. using 3 nozzles to the row and putting on approximately 140 gallons per acre.

It is thus seen that the production of 600 bushels per acre on this particular farm was no accident. The incorporation of a heavy growth of soy bean plants provided the necessary humus thus ensuring good moisture holding capacity of the soil, as well as considerable available plant food. Thorough plowing and preparation of the seed bed, good seed used liberally, a sufficient amount of commercial fertilizer to supplement that provided by the cover crop and the natural fertility of the soil, coupled with intelligent cultivation and unusually thorough sprayings, furnished the essential factors for the production of a large crop. When we take into consideration the fact that the average yield of Pennsylvania potato growers in 1930 was only 99 bushels per acre, and that this figure is much lower than the preceding years of 1925 to 1929 in which the average yields for the State were as follows: 123, 112, 120, 130 and 110 bushels per acre respect-

[1]Houston, A. V.—Methods employed in the production of Pennsylvania's high potato yield in 1930.—The Guide Post 8, No. 1 p. 1, 14, Feb. 1931.

ively, it is apparent that the weather conditions in the crop growing season of 1930 were not especially favorable to the production of a large crop.

General Observations

While further comment regarding the stimulating influence of the above clubs seems unnecessary it is difficult to refrain from again emphasizing their tremendous importance from the educational standpoint. In no other way could the potato growers of these several States have been so quickly and so thoroughly convinced of the value of increasing the humus content of their soils, deeper plowing, thorough preparation of the seed-bed, good seed, larger sized seed pieces, closer row widths and seed spacing in the row; pre-emergence tillage with weeder or spike tooth harrow, good subsequent cultivation to destroy weed growth, and early, frequent and thorough spraying of the plants for insect and disease control.

Non-competitive Large Yields

In order to complete the record of large acre yields of potatoes it seems desirable to include some individual records in which the motivating influence appears to have been a desire to find out the possibilities of acre production on a certain type of soil. Whether such motive was born of a desire to increase land values is not pertinent to the present discussion, which is limited to the recording of noteworthy accomplishments in potato production.

In 1924 Frederick H. Rindge of Stockton, California succeeded in producing 962.5 bushels of potatoes on an officially surveyed acre of land, the crop of which was harvested and weighed under the supervision of disinterested parties. This yield was heralded by Western newspapers as the largest on record but as the reader of this paper will observe it was slightly over 12 bushels less than that grown by the winner of the American Agriculturists' prize contest in 1890. Two years later the Zuckerman Bros., also of Stockton, announced their intention of breaking the acre yield potato record and set a date for the harvesting of a measured acre. To make certain that the highest yielding portions of a large field would be obtained they had nine separate acres and a fractional part of another duly surveyed, each of which was harvested and the yields separately recorded under the supervision of duly accredited parties.

The writer was privileged to be present at the "Field Day" gathering which was attended by several hundred interested visitors who witnessed the harvesting operations on that particular day. The results of this effort on the part of the Zuckerman Bros. to win the world's record for the largest crop produced on an officially measured acre, and the product of which was

weighed under the supervision of a disinterested party, were as follows:

Acre No. 1 = 1038.30 bushels
Acre No. 2 = 1033.02 bushels
Acre No. 3 = 1021.22 bushels
Acre No. 4 = 1031.93 bushels
Acre No. 5 = 1011.70 bushels ..... Average yield of the 9 acres = 1001.07 bushels
Acre No. 6 = 983.62 bushels
Acre No. 7 = 981.33 bushels
Acre No. 8 = 971.37 bushels
Acre No. 9 = 955.12 bushels

As will be noted five of the yields were in excess of 1000 bushels. The highest yielding acre made 1038.3 bushels while the lowest one yielded 855.12 bushels and the average yield for the 9 acres was slightly over 1000 bushels. This was truly a noteworthy performance.

In 1927 F. H. Rindge broke the Zuckerman Bros.' record with a production of 1078.3 bushels per acre. This record stood until 1929 when it was eclipsed by L. G. Schutte's record of 1145.17 which has been previously noted in the Colorado 600-bushel potato club's performances.

In concluding, the writer wishes to thankfully acknowledge the assistance of C. H. Metzger of the Colorado Agricultural College; A. E. Wilkinson of the Connecticut Agricultural College; R. W. Donaldson of the Massachusetts Agricultural College; J. J. Bird of the Michigan State College; H. R. Cox of the New Jersey College of Agriculture; E. V. Hardenburg of the New York College of Agriculture; E. B. Tussing of the Ohio College of Agriculture and J. B. R. Dickey, State College, Pa. These gentlemen very kindly furnished data in regard to the performance of their State potato clubs and thereby made possible the preparation of a considerable portion of this paper.

Crop and Market News

Potato Market Situation Still Weak

(Contribution by the Bureau of Agricultural Economics)

Potatoes for the entire year were still forecast in October at 357,000,000 bushels. There was relatively little change during September in the prospective production of late potatoes for the country at large although for individual states there were noteworthy changes. The crop in the 30 late states was forecast at 293,000,000 bushels or 2% smaller than the estimated 1931 crop. During September the 18 surplus states declined to about 250,000,000, while the 12 other late states advanced from a little less than 41,000,000 to more than 43,000,000 bushels, chiefly due to beneficial rains and favorable

growing weather in the central states. The yields secured from fields harvested up to October 1 indicated a larger crop in a number of the central surplus states than was forecast the month before, and a total gain of 2,300,000 bushels was shown for the group of five central shipping states. On the other hand, a decrease of 1,400,000 bushels occurred during September in the three eastern surplus states, due primarily to late blight in Maine causing premature dying of vines and rotting of tubers. Losses in several of the western states resulting from various causes, such as dry hot weather, water shortage and early frosts, were responsible for a net decline of 3,000,000 bushels in the western shipping group as a whole since September 1.

By October 22, the leading late-crop states had shipped only 27,000 cars of potatoes, compared with 43,300 the year before. This is a decrease of 38%, although production in those states is but 5% lighter than last season. The only states which had exceeded last year's output to that date were Colorado, Michigan, Oregon and South Dakota. The last state (South Dakota) was running very far ahead of last season's record. By late October, the peak harvest time movement had been completed and total shipments were again down to a daily average of 500 cars, chiefly from Maine, Idaho and North Central regions. At the same time last season, about 900 cars were moving each day.

Shippers of Round Whites in western New York about October 25 received 58c-65c per 100 pounds sacked, while Green Mountains in northern Maine returned 42c-45c. The f. o. b. price on Russet Rurals in Michigan was 40c-45c, while Cobblers returned 43c in Wisconsin and 37c-45c in Minnesota. The cash-track price on Bliss Triumphs in western Nebraska held at 40c-45c; Brown Beautys were rather weak in southern Colorado at 25c-30c and Red McClures returned 30c-35c. Southern Idaho quoted Russet Burbanks at 33c-40c per 100 pounds cash. Shippers in Yakima Valley, Washington, were receiving $8-$10 per ton of sacked Russet Burbanks, on a cash-track basis. The Chicago carlot market showed a slight weakness, with Northern Round Whites ranging 60c-70c, Red River Ohios 65c-70c, South Dakota Early Ohios 60c-65c and Idaho Russet Burbanks $1.10-$1.15 per 100 pounds. Maine Green Mountains were jobbing in the east at 85c-$1.05.

Announcement of the 19th Annual Meeting of the Potato Association of America to be held at the

Jefferson Hotel, Atlantic City, New Jersey

December 28 and 29, 1932

Review of Recent Literature

Asseyeva, T. Bud Mutations in the potato. Bul. Appl. Bot. Genet. and Plant Breed. 1931: 27 (4): 135-218.

A method of investigating certain types of mutants in the potato is described. By cutting away the eyes of the tuber to a thickness of ½ mm. shoots can be produced from the lower layers. The parts of the tubers with eyes removed in this manner produce plants with tubers like the original from which the mutant arose. In this way it was demonstrated that the mutation occurred in the superficial layers either in the epidermis, sub-epidermis or in both layers. The epidermal type is by far the most frequent, and the second and third types arise from this and not independently. These three types behave differently when the eyes are removed. The epidermal type is changed to the form from which it originated; the sub-epidermal type is partly changed to the original form and partly to the form in which both layers are affected on dichlamyds but in only two cases did the dichlamyds give normal tubers. It is possible that more than two layers of tissue were mutated in these.

The genetical behavior of the tuber color is briefly discussed.

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Salaman's genetic explanation is confirmed but in addition to Salaman's R there is present in some cases R, which in the presence of D does not produce color, also in another cross the presence of a factor X was demonstrated which checked the influence of the factors DA for colored eyes.

The color of the epidermal mutants is not transmitted through seeds. The progeny of the dichlamydeous mutants on the other hand showed clearly that the factors for color had been so transmitted. Of the 35 mutations recorded 12 might be considered as due to loss of a character and 23 as due to the gain of a character. In the first 12 cases the purple colors mutated into red or white, the red colors into white. In the other 23 cases the red color mutated to purple, the white color to purple or red. Other color mutations are described and mutations resulting in russet skin varieties noted. Some of the mutants have received names and have been distributed as commercial varieties. In five cases the flower color mutated simultaneously with the tuber color. Other cases of mutation in flower color without a change in tuber color were observed. Changes in form of different parts of the plant were not infrequent. Among these were forms with 5 distinct petals, form with composite inflorescences, various extreme types of leaf form and character, non-flowering forms of flowering sorts, parthenocarpic forms of sterile sorts, etc. Certain of these were also different in chromosome number. The wildings are considered in a class with other shape mutations, and not due to virus diseases as stated by Salaman.

Considerable data are quoted to show that mutations may occur for such characters as yield and disease resistance giving rise to new varieties. It is thought that the dominant changes are gene mutations but the occurrence of changes in several characters simultatneously is due to chromosomal aberrations. A further group is described certain of which are produced from the others by removal of eyes. In this case the original varieties transmitted the abnormalities by sexual reproduction.

At the end of the article a brief discussion is given of special technics which were used to change monochalmyds into dichlamyds. The eyes of the mother tubers were subjected to mechanical injury such as punctures, cuts and crushing; in other cases S. A. Gusseva and N. A. Lopatin subjected mother tubers to the influence of X-rays before planting. In both cases dichlamydeous sectors resulted. Mutants occurred as a result of mechanical injuries in from 0 to 6% of the cases but with X-ray treatments tubers were found in every plant with mutant sectors. Three of such sectors were often observed in the same tuber.

—F. J. STEVENSON.

Bloodgood, Dean W.—The Effect of the Frequency of Irrigation on Potatoes Grown in Mimbres Valley, New Mexico.—N. M. Agr. Exp. Sta. Bul. 205, June 1932.

The experiment was conducted on three soil types in the Mimbres Valley, at an elevation of 4331 feet, for the purpose of obtaining concrete data regarding the effects resulting from different frequencies of irrigation. Irish Cobbler certified seed potatoes from Minnesota were used in the tests. These studies extended from 1927 to 1931 inclusive. Each of the three fields used was divided into six plots. The general plan of irrigation practiced was as follows:—The first irrigation was just before planting time, usually about the middle of March; the second irrigation, about May 1, was applied to all of the plots. After the second irrigation, some of the plots were irrigated regularly at one, two, three or four-week intervals, while some were irrigated whenever the cooperator deemed it advisable. The furrow system of irrigation was used throughout the studies. The results secured indicated that the yields increased with the greater frequency of irrigation. The highest average yield per acre (157¼ bushels) was obtained from nine irrigations applied at one-week intervals after about May 3, using an average of 24.6 acre-inches of water. The highest estimated average duty of water, 494 pounds of potatoes per acre for each acre inch of water, was obtained with four irrigations, using an average of 12.2 inches of water.

Soil type was found to be an important factor, the fine sandy loam producing 74 per cent more marketable tubers with use of less water than the silty clay loam, the average yields being 8692 and 4998 pounds per acre-inches and 17.8 acre-inches, rewater, the sandy loam produced on the average 12,056 pounds of potatoes per acre. Soil texture also affected the grade of the potatoes.

Frequency of irrigations and amount of water applied was found to affect the grade of the potatoes. As the frequency of irrigations and the quantity of water increased, the percentage of No. 1 potatoes increased and the percentage of No. 2's decreased. The highest average percentage of No. 1 potatoes was obtained from plots receiving from seven to ten irrigations.

—W. STUART.

Announcement

of the

NINETEENTH ANNUAL MEETING OF THE POTATO ASSOCIATION OF AMERICA

to be held at the **Jefferson Hotel, Atlantic City,** New Jersey, December 28 and 29, 1932.

NOTE: Jefferson Hotel, NOT Lennox as stated in October number